

6. [4 marks] Find the derivative of the function $y = \frac{8x}{\ln(5x+1)}$.
- (a) $\frac{8(5x+1)\ln(5x+1) - 40x}{(5x+1)(\ln(5x+1))^2}$ (b) $\frac{1}{\ln(40x)}$ (c) $\frac{8\ln(5x+1) - 40x}{\ln(5x+1)(5x+1)^2}$ (d) $\frac{8}{5\ln(5x+1)}$
7. [4 marks] Find the derivative of the function $y = 5x^2e^{3x}$.
- (a) $10xe^{3x}(2x+3)$ (b) $5xe^{3x}(2x+3)$ (c) $10e^{3x}(3x+2)$ (d) $5xe^{3x}(3x+2)$
8. [4 marks] Find the derivative of the function $y = \ln(e^{x^2} + 1)$.
- (a) $\frac{2xe^{x^2}}{e^{x^2} + 1}$ (b) $\frac{2x}{e^{x^2}}$ (c) $\frac{2xe^{x^2}}{\ln(e^{x^2} + 1)}$ (d) $\frac{2e^{x^2}}{(e^{x^2} + 1)^2}$
9. [4 marks] Find any local maximum or minimum points of the given function. $y = x^3 - 3x^2 + 1$.
- (a) Minimum at $(0, 1)$, maximum at $(2, -3)$ (b) Maximum at $(0, 1)$, minimum at $(2, -3)$ (c) Maxima at $(-2, -19)$ and $(0, 1)$, minimum at $(2, -3)$ (d) Minimum at $(2, -3)$
10. [4 marks] Which of the following statements is true?
- (a) $f(x) = 2e^x$ is concave down for all x , and has no points of inflection.
 (b) $f(x) = x^5 + 1$ is concave up for all x , and has no points of inflection.
 (c) $f(x) = x^2 + 5$ is concave up for $x < 0$, concave down for $x > 0$, and has a point of inflection at $(0, 5)$.
 (d) $f(x) = (x - 5)^3$ is concave down for $x < 5$, concave up for $x > 5$, and has a point of inflection at $(5, 0)$.
11. [4 marks] Evaluate $\int \frac{\sec^2(\ln x)}{x} dx$.
- (a) $\tan(\ln x) + C$ (b) $\ln(\sec x) + C$ (c) $2\sec(\ln x) + C$ (d) $\ln(\tan x) + C$
12. [4 marks] Evaluate the definite integral $\int_0^\pi \sin^2\left(\frac{x}{2}\right) \cos^2\left(\frac{x}{2}\right) dx$
- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{8}$
13. [4 marks] Evaluate $I = \int e^{4x} \cos\left(\frac{x}{2}\right) dx$.
- (a) $\frac{1}{12}e^{4x} \left(3\sin\left(\frac{x}{2}\right) + 14\cos\left(\frac{x}{2}\right)\right) + C$ (b) $\frac{1}{23}e^{4x} \left(2\sin\left(\frac{x}{2}\right) + 3\cos\left(\frac{x}{2}\right)\right) + C$
 (c) $\frac{1}{65}e^{4x} \left(2\sin\left(\frac{x}{2}\right) + 16\cos\left(\frac{x}{2}\right)\right) + C$ (d) $\frac{1}{5}e^{4x} \left(\sin\left(\frac{x}{2}\right) - \cos\left(\frac{x}{2}\right)\right) + C$
14. [4 marks] Evaluate the definite integral $\int_0^3 e^{x/3}(x^2 + 2x) dx$.
- (a) 0 (b) $27e - 36$ (c) $e - 1$ (d) $21e + 40$
15. [4 marks] Evaluate the definite integral $\int_1^e (x \ln x)^2 dx$.
- (a) $\frac{e}{4}$ (b) $\frac{e^3 - 1}{2}$ (c) $\frac{5e^3 - 2}{27}$ (d) $\frac{e^2 + 1}{6}$
16. [4 marks] Evaluate $I = \int \frac{4}{x^4 - 1} dx$.
- (a) $\ln|x-1| - \ln|x+1| - 2\tan^{-1}(x) + C$ (b) $\ln|x^2+1| + 2\tan^{-1}(x) + C$
 (c) $\ln|x-1| - 4\ln|x+1| - 2\tan^{-1}(x) + C$ (d) $2\ln|x-1| + \ln|x+1| + \tan^{-1}(x) + C$
17. [4 marks] Let $f(x) = \sin(\sin 3x)$. Evaluate $f'(\pi/2)$. In other words, find the derivative of f at $x = \pi/2$.
- (a) $f'(\pi/2) = 0$ (b) $f'(\pi/2) = 1$ (c) $f'(\pi/2) = 2$ (d) $f'(\pi/2) = 3$